THE FOSSIL COLLECTOR

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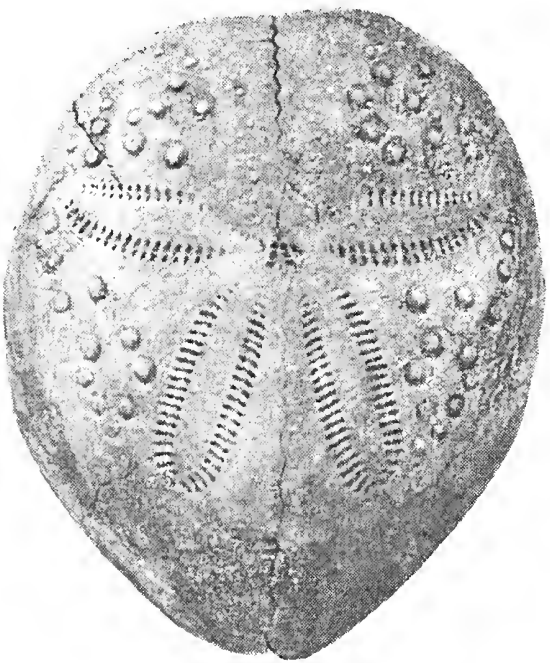

Eupatagus murrayensis Laube 1869, x2. Early Miocene, Mannum Formation. Younghusband, South Australia.

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Taxonomic Disclaimer

This publication is not deemed to be valid for taxonomic purposes [see article 8b in the *International Code of Zoological Nomenclature* 3rd edition 1985. Eds W. D. Ride et al].

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EDITORIAL NOTES

Welcome to Bulletin No. 58 and the last issue of this the twentieth century, it only seems like yesterday when I would lay in bed as a child and think the year 2000 was so far away.

July saw the addition of a new member to the Tierney family with the birth of our second daughter Nakita Ann. Nakita weighed in at 3590 grams (7lb 14½ oz) and was 52 centimetres (nearly 21 inches) long, this put her 250 grams and one centimeter behind her big sister Ayla. Although we had to accept what we were given, Julie and I were hoping for another girl, I cannot answer why we felt this way as most people would prefer one of each. I did mention to the midwife that delivered Nakita that I am now outnumbered three to one and she suggested I buy a dog, but unfortunately we don't need a dog as I am responsible for cleaning up all the scraps. I guess the only thing for this is to build another shed in the yard so that I have somewhere to hide. Ayla has been a perfect big sister with not a hint of jealousy (so far), she has been very loving and caring and is very concerned when Nakita starts to cry. Are we having any more kids, well, no. This was a particularly difficult birth for Julie as Nakita decided to turn the week before she was born and then stayed in the posterior position. Nakita's heartrate also dropped just before she was born so the posterior delivery along with the urgency to have her delivered quickly made for a fairly tough time and that is something I would not want Julie to go through again, I will remind her of this in a couple of years time.

It was great to receive a visit from Tasmanian reader Philip Sansom and to be able to swap some fossil specimens and have a good yak, thanks Philip. It was only a pity that the Sunshine State turned on the rain for Philip and his family, yet again.

The rain here in Queensland (the southeast corner anyway) has been a bit of a problem since El Ninó removed her influences from our shores. For the first seven months of 1999 my backyard has received over 1500 mm of rain and while this is not a lot when compared to some other parts of the State it is when the average annual rainfall for my area is around 800 mm. I guess on the upside of my complaining is that some of the worse effected drought areas have also had rain and for these people I am happy to see that their lives will hopefully be somewhat better after the rain.

For those people who might be interested in receiving something for very little. I have an extra copy of the book *The Natural History Museum Book of Dinosaurs* by Tim Gardom which I would like to give away, it is the softcover version and is quite a good book. To have a chance of owning this book is fairly simple, just write me a letter telling me why you like the science of palaeontology and what you hope to gain by collecting and studying fossils. I must point out that as with anything like this, there are some rules and these are:

1) The judges decision is final.
2) There is no restriction on age.
3) The person who receives the book will be a member of the F.C.A.A.
4) Closing date for letters is November 15, 1999.

While on the subject of books, does anyone have copies of the *Fossils of Queensland* (Edited by Hill, Playford and Woods) series of softcover books which they no longer want? If this is the case then please contact me as I would like to add this series to my library. They were published between the 1960's and 1970's by The Queensland Palaeontological Society and cover all geologic periods from the Cambrian to the present.

Readers will notice that this issues In The News section has a few articles sourced from the internet. I was quite surprised to see that most of the scientific journals, the major newspapers, and also the Discovery Channel have palaeontological type stories available on the internet. Finding these areas will be advantageous in the sense that I will now be able to report on palaeontology subjects that the average person (including me) would not know about. This will also make for a possibly larger than usual In The News section which may contain some weird and wonderful, and sometimes unbelievable, stories on what is happening in other parts of the world. Although I may not personally agree with some of the theories put forward in these news articles, I will include them so that readers might receive some sort of balance and varied opinion of what is happening in the world of palaeontology.

As is customary for this issue, Julie, Ayla, Nakita and myself would like to wish all readers of *The Fossil Collector* and their families a very safe and happy Christmas/ New Year period and that Santa brings you everything you might wish for.

The deadline for the next issue Bulletin No. 59 is Friday November 5, 1999.

MURRAY MAGIC

East Front Road (Riverside Drive), Mannum to Bow Hill, South Australia.

Chris AhYee and Janice Krause 20 Bayley Street, Hamilton, Victoria. 3300.

The cliffs of the Murray River, on the western fringe of the Murray Basin, yield a wealth of Tertiary marine fossils. These fossils occur at various levels throughout the cliffs but can be more easily collected from the weathered material, fallen boulders and scree, at the base of the cliffs and in road cuttings.

One section along the Murray River where Early Miocene Mannum Formation fossils are abundant is along the southern river road heading east from Mannum. This is the East Front Road, known locally as Riverside Drive, an alternative river front tourist road from Mannum to Bow Hill via Younghusband, on the left bank of the Murray River (see map). In this area the light yellow-brown fossiliferous calcareous sandstones and sandy limestones of the Mannum Formation abound. Deposition of the formation began near the end of the Oligocene Epoch about 24 million years ago, however, the basal part of the formation is not exposed on the surface. These calcareous sandstones and sandy limestones are sufficiently dense to form vertical cliffs, as can be seen at Younghusband, Coolcha Landing Recreational Reserve, and numerous other localities further upstream.

MANNUM PUMPING STATION [Locality 1]

The Stratotype (Type Section) of the Mannum Formation (Ludbrook 1961) is at the Mannum Pumping Station, River Lane, Mannum. Unfortunately it has been largely rendered inaccessible by building construction, which conceals the basal four metres, and by angle cutting of the upper portion of the outcrop (Lukasik and James 1998). Although Ludbrook (1961) divided the original exposure of the formation into lower and upper members, this subdivision is informal and often difficult to trace in other outcrops.

GRANITE QUARRY RESERVE [Locality 2]

The first collecting locality can be found by heading east (upstream) for 2.4 kilometres along the left bank of the Murray River from the Mannum to Bow

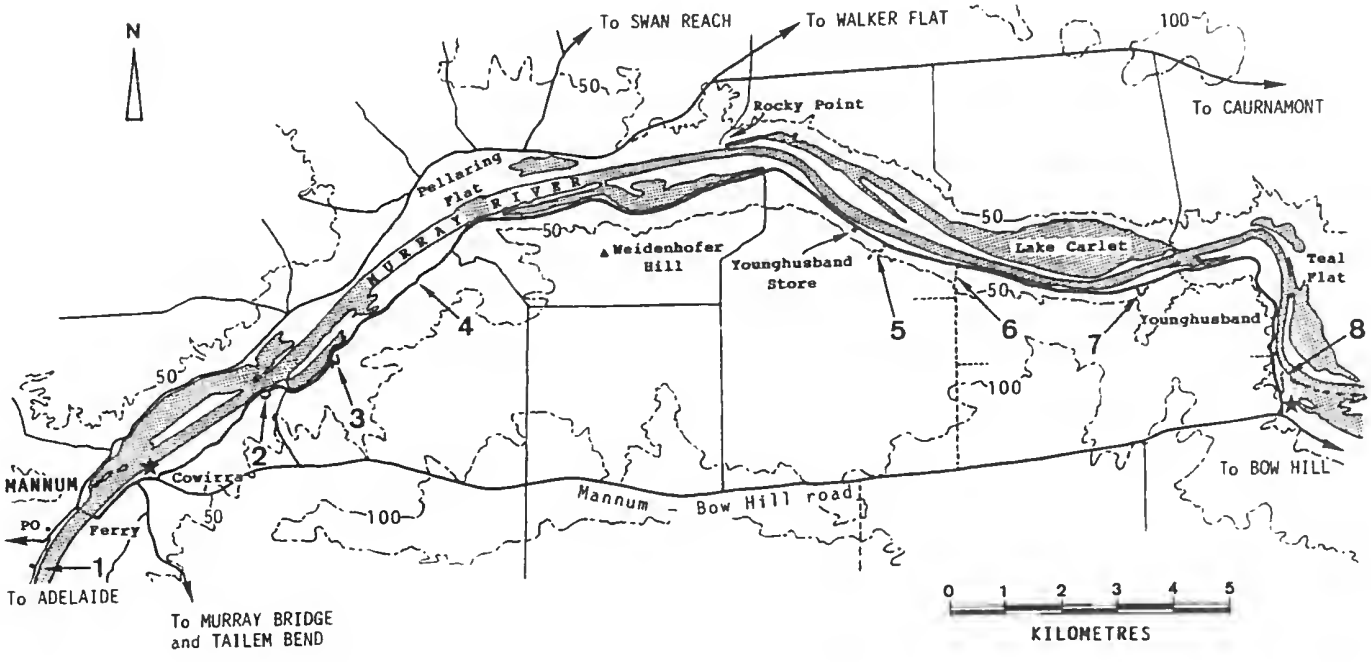
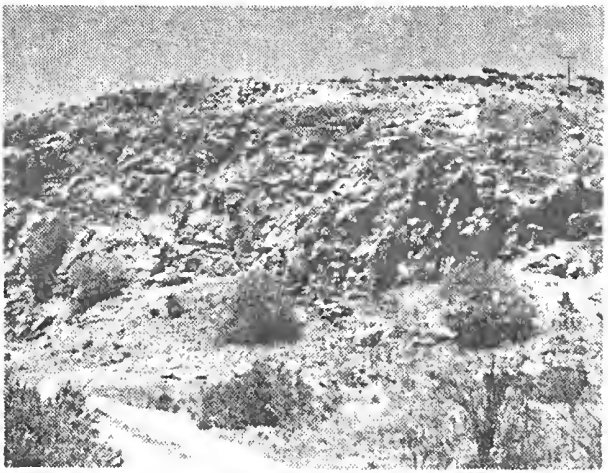


Figure 1. Map of localities along the riverside tourist drive (East Front Road) on the south side of the Murray River, between Mannum and Bow Hill, South Australia. 1. Mannum Pumping Station; 2. Granite Quarry Reserve; 3. "Benched" quarry: 4. Kia Landing Marina; 5. "Blocked off" road, Younghusband; 6. Chambers Road; 7. Small roadside pit, Younghusband; 8. Coolcha Landing Recreational Reserve.

Hill/East Front Road intersection at Cowirra (some 350 metres east of the junction with the Mannum to Murray Bridge road). It is a pinkish granite quarry cut into the hillside with a pronounced black dyke running nearly vertical through the quarry face. The smooth surface of this granite inlier is covered with a few feet of coarse rubbly calcareous sandstone (Ludbrook 1961). Historically the granite was quarried and shipped downstream to form the barrages at the Murray River mouth near Goolwa. Thought to be an island near the beginning of the Late Oligocene-Middle Miocene marine transgression, the granite was at some time submerged to a shallow depth. Specimens of small clypeasteroid echinoids up to 15mm in size, generally referred to as *Scutellinoides patella* (Tate 1891) but now considered to be a species belonging to the family Fossulasteridae, can be found on top of the granite outcrop. The heart urchin *Lovenia forbesii* (Woods 1862) and occasionally the holasteroid *Corystus dysasteroides* (Duncan 1877) are also to be found at this location. Associated with the echinoids are brachiopods, bivalves, foraminifera and numerous segments of free swimming crinoids known as comatulids.



Locality 1 (left). Mannum Formation as exposed before levelling for the Mannum Pumping Station, circa 1953 (Ludbrook 1961).

Locality 2 (above). Granite Quarry Reserve, East Front Road, near Mannum.

BENCHED QUARRY [Locality 3]

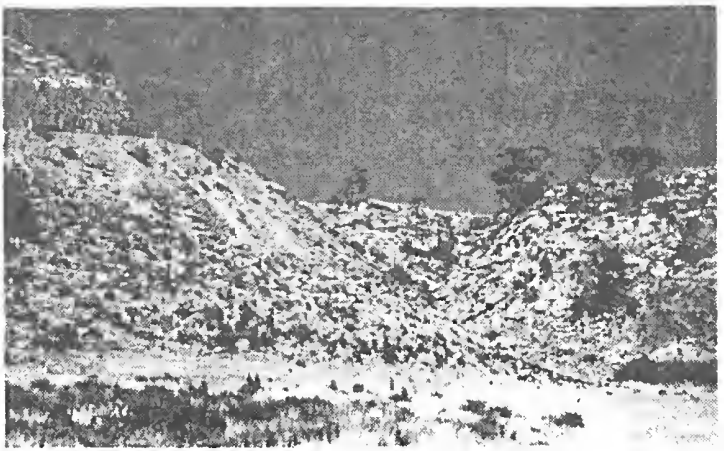
A very large limestone quarry with two of three bench levels is situated 4.0 kilometres from the intersection. This was quarried mainly for road making material and comprises hard marl to soft sandy limestone. It is a very rich location for echinoids such as species of Fossulasteridae, small *Fibularia gregata* (Tate 1885), *Lovenia forbesii*, and *Ortholophus woodsi* (Laube 1869). The higher benches and washouts contain near circular *Monostychia* sp. and species of *Eupatagus*, mainly *E. murrayensis* Laube 1869.

KIA LANDING MARINA [Locality 4]

In the last few years a large marina complex, known as Kia Landing Marina, has been developed between Riverside Drive and the river 6.6 kilometres from the intersection. Filling for the embankments came from a new limestone pit situated approximately 1 kilometre to the south of the road, opposite the western end of the complex. Although the material was relatively fresh when the authors visited this site, a good collection of large *Lovenia* and thin edged *Monostychia* sp. (up to 60 mm in diameter) were found.

"BLOCKED OFF" ROAD [Locality 5]

About 500 metres past the Younghusband General Store and adjacent caravan park complex, 15.1 kilometres from the intersection, is a new housing estate at the back of which is an unsealed road cut into the cliff face. Being far too dangerous for vehicular traffic this road is now closed but does provide easy access to the higher sections of the cliff. The surplus material from the road cutting was simply pushed over the side into the gully where many fossils, echinoids predominating, can be found among the weathering spoil. On and near the top of the cutting large specimens of *Lovenia forbesii* occur. Other echinoids to be found include *Apatopygus* sp., *Echinolampas* sp., various *Eupatagus* spp., *Ortholophus woodsi*, the marsupiate temnopleurid *Paradoxechinus novus* Laube 1869, the hemiasterid *Psephoaster klydonus* McNamara 1987, *Monostychia australis* Laube 1869, *Monostychia* sp., and the unusual neolampadid *Notolampas flosculus* Philip 1963.



Locality 5. "Blocked off" road, Younghusband.

CHAMBERS ROAD [Locality 6]

Further east, 17.1 kilometres from the intersection, a recently up-graded and sealed road on the south side of Riverside Drive (Chambers Road) leads up through a new cutting where surplus limestone material has been pushed to either side. Like the quarry at Kia Landing Marina, further weathering should yield a good supply of fossils with echinoids again dominating. One interesting feature of this location is the unusually large size of the echinoids found here, some specimens of the brissid *Cyclaster archeri* (Tenison Woods 1867) reaching 100 mm in length. Other unusual brissid species to be found are the large *Amoraster tuberculata* McNamara and AhYee 1989, and *Eupatagus cetus* Kruse and Philip 1985, the most inflated species of *Eupatagus* known in Australia and found only in the Mannum Formation.

SMALL ROADSIDE PIT, YOUNGHUSBAND [Locality 7]

A small pit on the south side of the road, 20.3 kilometres from the intersection, has yielded a variety of echinoids and other fossils both in loose boulders and the many washouts. The small (2 mm and upwards) *Fibularia gregata* can be found with many small fossulasterids, among them the marsupiate *Willungaster scutellaris* Philip and Foster 1971. In the softer bands, good clean *Eupatagus* spp. and large

Lovenia forbesii (up to 50 mm in length) are common. A careful search through the washouts at the rear of the quarry will often bring to light good specimens of *Corystus dysasteroides* and even a rare specimen of *Pericosmus compressus* (Duncan 1877). Pectens, pieces of scaphopods (tusk shells) with their hard calcareous tubes, comatulid segments and occasionally sharks teeth are also known from this location.

Following this last small quarry, the road eventually turns inland and winds steeply up the escarpment to reveal commanding views over the River Murray around Teal Flat and further east towards Bow Hill.

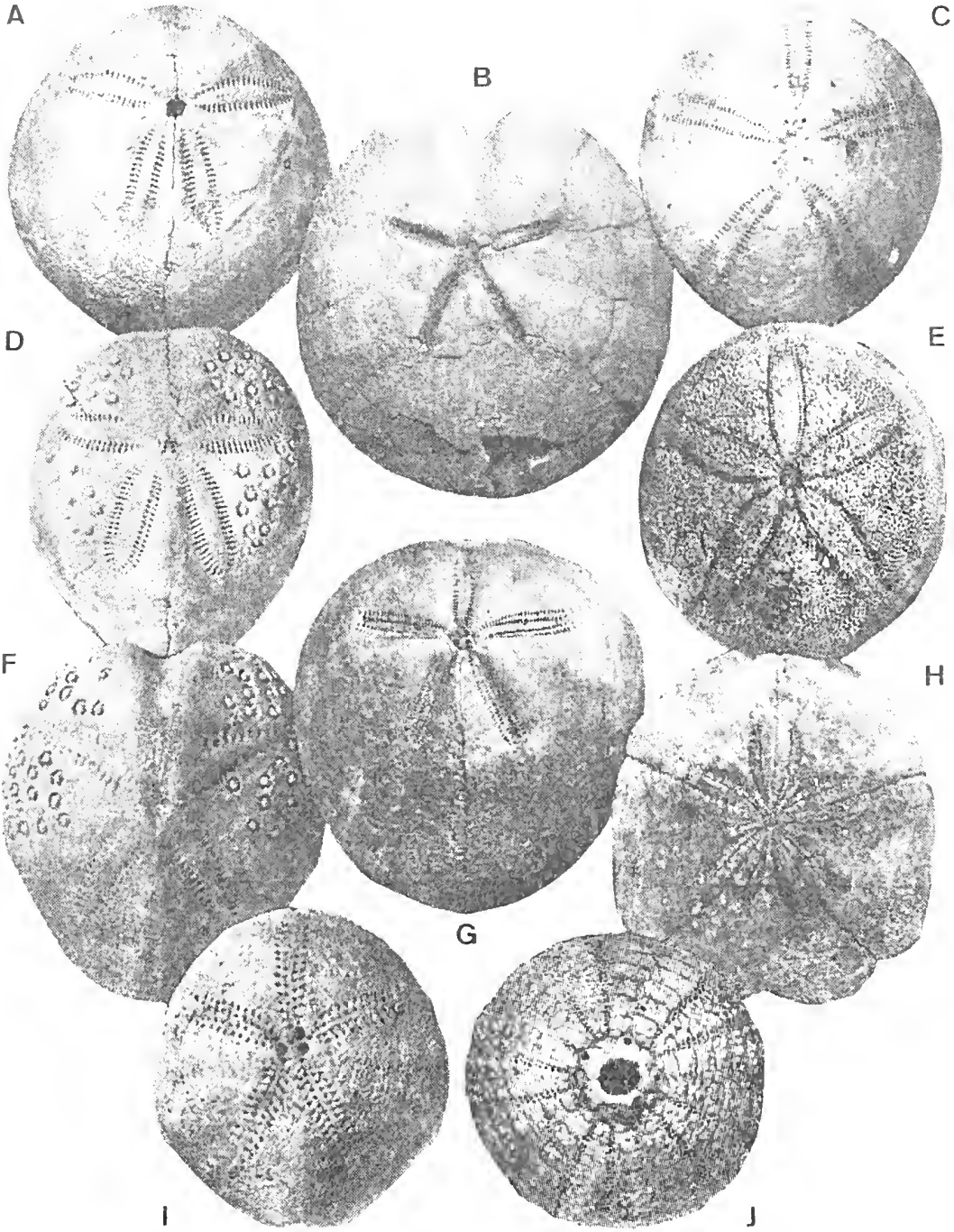
COOLCHA LANDING RECREATIONAL RESERVE [Locality 8]

Finally, 27.2 kilometres from the start of the East Front Road, just before it rejoins the main Mannum to Bow Hill highway, a dirt track turns off sharply to the left and drops steeply down to a small reserve at the side of the river known as Coolcha Landing. Unfortunately this track is not signposted and can easily be missed. As one deseends down the track, vertical cliffs appear on the left with a narrow foot

Figure 1 (right). Some typical Mannum Formation echinoids that may be found along the riverside tourist drive (East Front Road), Mannum to Bow Hill, South Australia.

A, *Amoraster tuberculata* (68 mm);
B, *Pericosmus compressus* (87 mm);
C, *Corystus dysasteroides* (66 mm);
D, *Eupatagus murrayensis* (42 mm);
E, *Echinolampas gambierensis* (50 mm);
F, *Lovenia forbesii* (49 mm);
G, *Cyclaster archeri* (70 mm);
H, *Monostychia australis* (45 mm);
I, *Studeria elegans* (20 mm);
J, *Ortholophus woodsi* (18 mm).

Dimensions in parenthesis indicates the length of the specimens illustrated, except in the case of *Ortholophus* (J) which is the diameter.


A
B
C
D
E
F
G
H
I
J

Locality 7 (above). Small roadside pit, Younghusband.

Locality 8 (right). Cliffs at the back of Coolcha Landing Recreational Reserve, near Bow Hill.

track at the base following the top of the scree slope. The cemented limestone is relatively hard but softer pockets will yield numerous echinoids, in particular *Studeria elegans* (Laube 1869). In the cutting near the top of the track the rare neolampadid *Actapericulum bicarinatum* Holmes 1995, and *Psephoaster klydonus* can be found with specimens of *Ortholophus woodsi*. These cliffs continue downstream for about 300 metres before plunging vertically into the river. **WARNING: Most of the cliffs at this locality have been severely undercut by weathering leaving the top of the formation overhanging the upper section of the scree slopes. Collecting in these situations is always dangerous.**

In addition to the eight locations listed in this article, it would be fare to say that the many small cuttings along the route, as well as the numerous cliff sections just off the road, are well worth inspection. Care should be taken as these properties and grazing land are privately owned, with the exception of the two public reserves (localities 2 and 8), and often have undefined boundaries.

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WHAT IS TAPHONOMY

Lynne M. Clos

This article first appeared in ***Fossil News: Journal of Amateur Paleontology***, Volume 5, Number 2 - February 1999. Permission to reproduce given by the author.

Taphonomy is the study of all the processes affecting an organism from its death until its transformation into a fossil. Rarely are organisms fossilized pristine; they usually are affected by taphonomic processes during the transition. Thus, it is important to understand these processes so one can work backwards from the fossil to a reconstruction of the living organism and the paleocommunity from which it was derived.

Taphonomic processes are divided into two groups: biostratinomic processes, which operate on the organism prior to burial, and diagenetic processes, which

occur after it has been entombed. Understanding of both can give important information about the environment of fossilization.

BIOSTRATINOMIC PROCESSES

Imagine a vertebrate animal which dies on a river floodplain. Initially the skeleton is fully articulated, but unless a flood deposits sediment upon it quickly after death, it is unlikely to remain that way First, the carcass is likely to be scavenged, resulting in partial disarticulation. The bones are exposed to sun, wind, rain, etc. for a period which may amount to many years. Further degradation and disarticulation will probably occur as cartilaginous connections decay and the bones begin to weather. If scavenging has not been too extensive, elements of the whole skeleton will remain within a small area. If the river floods and deposits sediment atop the bones, but with low enough energy not to transport them anywhere, the fossil we find can safely be assumed to have lived in the area where its remains are ultimately found.

Sometimes fossils of many conspecific animals are found concentrated in the same place, forming a bone bed. This usually occurs when some natural catastrophe overtakes a herd of animals. Perhaps the animals were hanging out at a water hole as it dried up, many did not survive until the next rains came. An assemblage of this sort will frequently contain an abundance of juveniles and geriatric individuals, since they are most susceptible to environmental stress, while animals in their prime have a better chance of surviving until conditions improve. Modern African elephants will push young ones out of the way of the water in an attempt to save it for themselves. Even if the water does not totally dry up, many animals will die of starvation as food resources in the vicinity of the water hole become depleted. Bones found in this sort of a concentration will frequently be disarticulated even if there has been minimal scavenging, and many will be broken, because the herd milling about in a small area has a tendency to trample dead individuals.

Another type of catastrophic mass mortality is that of a herd of animals caught in a flash flood, or drowned trying to cross a swollen river. Migrating animals such as caribou and wildebeest frequently encounter this sort of hazard, and many are lost. In this case the age structure of the fossils is more likely to be indicative of the

population structure as a whole. This is one way in which these two types of catastrophic assemblages can be differentiated. Also, the extensive trampling and breakage of bones will usually be absent, because the animals do not spend an extensive amount of time in the area. Articulated skeletons will be more frequent: dozens or hundreds of individuals will wash up on sandbars, and scavengers will become satiated, leaving many carcasses to decay undisturbed.

Both of the examples above create what is called autochthonous assemblages, that is, groups of fossil animals which lived in the local community. Not all biostratinomic processes forming a bone bed produce glimpses into only the local community. Bones may be transported by rivers and concentrated on sand bars, and thus sample a variety of communities upstream, these are called allochthonous assemblages. Studies have been done in the field and in the lab on a variety of modern vertebrate animals to determine how bones respond to flowing water. Some bones float or roll easily along the river bed, and are thus winnowed from the skeleton early on. Ribs and vertebrae are particularly easy to move. Skulls, jaws, and teeth are notoriously hard to entrain, and tend to form lag deposits in the area of death. Thus the composition of a fossil assemblage can give clues to the extent of transport. Abrasion and breakage are also important in determining the amount of transport which has occurred. Noting, of course, that delicate bones are more subject to breakage than robust ones, the amount of abrasion is generally assumed to be a function of transport distance and environmental energy. Comparing the condition of various bones in the deposit may indicate which ones were derived from close to the site and which ones washed in from much farther away.

Paleocurrent direction can be inferred, even in the absence of sedimentary structures, from the orientation of the bones in the deposit. Long bones will usually align themselves with the current and with their large ends pointing downstream. This does not only apply to vertebrate elements. Crinoid columnals likewise will frequently either roll transverse to the current or align themselves with it. Finding two preferred orientations perpendicular to one another can indicate the marine paleocurrent.

Marine sedimentation rates can be inferred from the amount of degradation of shells which have sat for a long time half buried in the sand. The buried portion will sustain no abrasion, while the exposed portion will erode somewhat and also

be exposed to the attacks of encrusting organisms. Low sedimentation rates will produce assemblages rich in epibionts, whereas high sedimentation rates resulting in rapid burial will produce "cleaner" shells.

The orientation of fossils in marine deposits can indicate the type of depositional environment. Low energy deposition results in horizons in which most bivalves are found concave-up and other organisms are flat with the bedding planes. Turbidite slumps are more likely to produce more random orientations of shells. Extensively bioturbated sediments also may show little stratification.

DIAGENETIC PROCESSES

Diagenesis sets in once the organism has been entombed in sediment. Compaction is an example of a mechanical diagenetic process. Shells and logs may become flattened and distorted as the weight of sediment atop them increases. Many diagenetic processes are chemical, in an aqueous environment that is high in iron and organic matter and low in oxygen, fossils will frequently become permeated by iron pyrite crystals. Such conditions are usually found in fine terriginous sediments, as limestones are low in iron and coarse sediments are not good at excluding oxygen. There are some beautiful examples of pyritized brachiopods and trilobites from upstate New York. The presence of pyrite is a strong indicator of anoxic conditions subsequent to burial.

Localized pockets of low oxygen in otherwise aerated sediments may form as the organic matter in an organism decays. This can result in the precipitation of hard minerals, leading to the formation of concretions surrounding the fossils. A well known example of this is the Mazon Creek fossil leaves.

Differential preservation of certain types of fossils can also occur under the right chemical conditions. Aragonite shells are more soluble than calcite ones, and phosphatic ones are more resistant still. A fossil deposit may contain pristine phosphatic fossils such as fish bones and conodonts, whereas the aragonite shells of many marine organisms will be highly eroded and perhaps only present as sediment-filled molds.

The local areas of low oxygen found surrounding decaying logs encourage the

deposition of silica found in groundwater. The silica is deposited in the pores of the wood, turning the log to stone. Silica is only minimally soluble in groundwater, and is frequently derived from the chemical alteration of volcanic ash to clay.

This has only been a brief survey of some common taphonomic processes. There are many more which have not been mentioned here. However, you can see that understanding these processes can give valuable information about the paleoenvironment both before and after burial of an organism. This allows the paleontologist to better reconstruct the paleocommunity from which the fossils derive.

IN THE NEWS

Long-Necked Dinosaur View Changes (Maybe).

Despite the long-necked dinosaurs portrayed in the hit movie Jurassic Park, a new study suggests that many of these ancient creatures couldn't raise their heads above their shoulders, much less nibble on treetop leaves.

Palaeontologists Michael Parish, of Northern Illinois University, and Kent Stevens, of the University of Oregon, developed "Dinomorph", computer software to test how fossilised vertebra fit together. They propose that big plant eating sauropod dinosaurs had a low slung, cow like posture. "It's so different from the prevailing model in popular literature," says Parish.

Based on detailed computer modeling of *Apatosaurus* and *Diplodicus* skeletons at the Carnegie Museum of Natural History, Parish and Stevens have concluded that the giant plant eaters probably held their necks in a neutral, almost level position, and could easily curve their necks downward. However, curving upwards was a problem because of a limited range of motion, more side to side than up and down.

The more picturesque, upright pose for sauropods seen in movies and museums has been fashionable for about thirty years, say Parish, probably because it looks more dramatic and it allows sauropod skeletons to fit better into museums. While a lot less visually striking, the low headed profile is attractive to many

palaeontologists because it eliminates some vexing problems created by the high headed posture.

The biggest problem is how to account for a towering 30 ton *Apatosaurus* getting blood to its brain. Some scientists have proposed that big sauropods had a second heart to help lift blood to their heads, with less uplifted postures, the extra heart is unnecessary. "I think it makes a lot of sense from a cardiovascular point of view," says University of Pennsylvania dinosaur researcher Peter Dodson about the lower posture.

Rather than eating tree leaves, long necked sauropods probably stood on the shores of lakes, rivers and marshes and ate low lying ferns and horsetails, says Stevens. A sauropod's great weight probably made muddy lake bottoms too dangerous for wading and long necks enabled easier access to the shoreline vegetation without the danger of getting bogged down.

Summary of report from *Discovery Channel Online*, April 30, 1999.

First Transatlantic Dinosaur Found.

It has been discovered that the same flesh eating dinosaur terrorised creatures in both Europe and North America. Hip and leg bones discovered in Portugal have shown for the first time that the same species of dinosaur stalked both continents 150 million years ago.

"It's a very important discovery as it gives us some specific information about how wide the Atlantic was at the time the dinosaur lived." Professor Mike Benton, of Bristol University, told the BBC.

Professor Benton said that when the dinosaurs originated 225 million years ago, all the continents were close together, but they started to drift apart soon after that. By 150 million years ago, the Atlantic is thought to have been 200 to 300 kilometres wide and far to deep for dinosaurs to cross from one side to the other.

The new discovery shows that significant land bridges between Europe and North America must have remained, even when the new ocean was quite wide, these land bridges may have been near Greenland.

The fossil bones are from *Allosaurus fragilis*, a creature similar to the better known *Tyrannosaurus rex*. Many *Allosaurus* fossils have been found in North America, but the Portuguese finds are the first in Europe which can be positively identified as the same species. Although the bones were found over ten years ago, in Leiria in west central Portugal, they have only recently been studied.

Summary of report from *BBC News Online*, April 29, 1999.

Lion Lizard Combo Found.

Peter Ward, a palaeontologist at the University of Washington, has unearthed some dramatic fossils in his day but nothing quite like the one he found late last year in South Africa. Ward's discovery, the first complete skeleton of a 250 million year old beast called a gorgon, resembled a cross between a lion and the fierce monitor lizard of Indonesia. The seven foot long (almost 2.15 metres) fossil offers a detailed look at a predator that lived long before the dinosaurs.

Until now researchers had found only skulls and a few scattered bones of gorgons, scant evidence that said little about what the animal's body looked like, even their best guesses might have missed the mark, says Ward. The gorgon had a leonine 2½ foot long (75 cms) head, four inch long (10 cms) canines and eye sockets on the sides of it's skull.

The fossil hints at the fierce brutality of life in the Late Permian Period. "Knowing how efficient the predators were gives us a better sense of what the prey was like," says Ward, a deadly predator like the gorgon would not have evolved without tough prey. That world ended 250 million years ago when a mysterious mass extinction (one far more severe than the catastrophe that killed the dinosaurs 185 million years later) wiped out gorgons, their prey, and ninety percent of most other life on Earth.

Summary of article which appeared in *Discover*, April 1999.

Bumpasaurus.

Countless books and magazines feature drawings of dinosaurs, but truth be told, no one really knows what dinosaurs looked like, fossil skin samples are extremely rare, only a dozen or so have ever been found. George Basabilvazo, a University

New Mexico graduate student, recently discovered some fossilised skin, along with the bones of a duck-billed dinosaur and unlike the smooth skinned animals that have been imagined by some artists, this dinosaur was as warty as a toad.

Basabilvazo uncovered the 70 million year old fossil just west of Deming, New Mexico and palaeontologist Spencer Lucas, of the New Mexico Museum of Natural History and Science in Albuquerque, which houses the fossil, speculates that the dinosaur's body was swept into a lake and quickly covered by silt which has helped preserve it's skin. The dime size (around the size of an Australian five cent piece), mushroom like bumps visible on the skin increased the skins surface area and might have allowed the dinosaur to shed excess body heat more quickly, says Lucas.

Lucas laments the rareness of dinosaur skin fossils, "if we could understand more about their skin, we might gain more insight into how diverse dinosaurs were."

Summary of article which appeared in *Discover*, May, 1999.

Oz Lion a Superbeast.

An ancient superbeast once roamed Australia's landscapes tearing the legs off kangaroos and terrorising the rest of the animal world, but to date it has been virtually ignored by science. Now palaeontologists are convinced this group of mammals known as marsupial "lions", in particular one species *Thylacoleo carnifex*, were possibly the most fearsome predators on the planet.

Australia, after years of being regarded as having an impoverished mammal predator history, now officially has its own bona fide super predator, which by new estimations was the most successful meat eater of its time, and it had a pouch.

Weighing upwards of 260 kg, *Thylacoleo carnifex* has now been assessed as being at least as formidable as the most famous of Tertiary predators, the sabre-toothed cat, and larger than a modern lion.

In a scientific paper soon to be released, Australian Museum and Sydney University's Macleay Museum palaeontologist Dr Stephen Wroe reveals that the ferocity, size and role filled by *Thylacoleo carnifex* has been previously grossly

underestimated. The findings support a minor revolution in the understanding of Australia's mammalian evolution. "That Australia was seen as a continent never graced by a large warm blooded carnivore had always bugged me," he said. "As things stood, Australia was the only continent, bar Antarctica, that had never had a bona fide mammalian super predator.

The marsupial lions lived from about 8 million years ago until as recently as 50,000 years ago. Dr Wroe said the largest of these animals was still alive when the first humans arrived in Australia, "it would have given them something to think about," he said.

Summary of story in *The Sunday Mail*, June 13, 1999.

Day of the Centipede.

A bulky centipede like creature that died out some 300 million years ago is the largest arthropod yet discovered. Palaeontologists in Germany who examined a partial fossil unearthed near Jena in the east of the country say it would have reached a length of 2.3 metres and a breadth of 50 centimetres.

The researchers calculated the creature's size by looking at the proportions of smaller, related species. "As only remnants were available for analysis, we had to extrapolate its dimensions," says Jörg Schneider, a palaeontologist at Freiberg University. It belongs to the genus *Arthropleura*, but the creature has not yet been given a species name. The largest modern arthropods are marine spider crabs, which have spindly legs up to 1.5 metres long, however, the bodies have a diameter of around 50 centimetres, so their bulk is much less than that of the mammoth *Arthropleura*.

Schneider says the creature inhabited estuarine marshes, probably feeding on amphibians and smaller invertebrates. Why it became extinct is unclear, but a drying of its habitats and the rise of reptiles, which would have competed for prey or even preyed on it, could have been to blame.

Summary of report from *Newscientist On Line*, June 21, 1999.

Katydid Fossils Found in Denmark

Katydids were singing pretty much the same song 55 million years ago that they do

today, researchers analysing new fossil evidence have reported. The katydid fossils, discovered in Denmark, represent the oldest known evidence of insects communicating by making distinct noises. Scientists from the University of Gottingen in Germany drew their conclusions from 20,000 bushcricket, or katydid, specimens preserved in ocean sediment.

Many of the fossils contain finely detailed impressions of the insects' wings and forelegs. They show that the prehistoric katydids were calling out to potential mates back then much as they do today, by scraping their wings together. From the fossils, the researchers were able to recreate the creature's tune, producing a rare sample of what Earth may have sounded like long ago. That song will be used in exhibits in Danish museums.

"When you listen to living bushcrickets today, some of them are making two songs, they are modulating them and making pauses. We guess that these ancient bushcrickets were singing only one main tone without pauses," said Jes Rust, a professor of zoology and palaeontology at Gottingen.

David Grimaldi, curator of entomology at the American Museum of Natural History in New York, said the fossils push evidence of insect communication 15 million years further into the past. Similar organs are seen in crickets trapped in 40-million-year-old amber, he said. While the northern tip of Denmark's Jutland peninsula, ,where the fossils were found, is chilly and windswept today, the region was a subtropical jungle when the insects were alive.

Summary of story in *Associated Press Headlines* (Online), June 17, 1999.

Oldest Fossil of a Beaked Bird Found.

Palaeontologists have found a fossil of the oldest known bird species with a beak, an upturned bill resembling Woody Woodpecker's. The 130 million year old, crow sized *Confuciusornis dui* was discovered last year in ancient lake sediments in China, so exquisitely preserved that impressions of its feathers are clearly visible. Previously, the earliest known toothless, beaked bird dated from about 70 million years ago.

The creature's beak was an advanced trait for its time, coming only 10-15 million years after the first known bird, the toothy reptile like *Archaeopteryx*, during the

Jurassic Period. *Archaeopteryx* had a reptilian snout rather than a beak of horn like material. The rear of *Confuciusornis dui's* skull is primitive, with two openings behind the eyes that are a throwback to the dinosaurs. "What you've got is a modern car engine hood on the front end of a Model T," said Larry D. Martin, curator of vertebrate palaeontology at the University of Kansas' Museum of Natural History, who helped analyse the fossil.

This combination of primitive and advanced traits suggests that early bird evolution was more complex than previously thought and included many species that didn't succeed. "This is showing a diversity we didn't know about before, it's not like you have this sort of straight-line evolution from one to another and each one getting more specialised," said Storrs L. Olson, curator of birds at the National Museum of Natural History at the Smithsonian Institution. Sankar Chatterjee, a professor of geology at Texas Tech University in Luddock, agreed: "The story is much more complex, evolution is not really like a ladder, it's more like a bush."

American scientists and a team from the Chinese Academy of Sciences, who analysed the fossil, believe the bird flew well and took off by scaling trees and jumping. *Confuciusornis dui* is the smallest species found to date of the order named for the Chinese philosopher; they became extinct about 120 million year ago and probably didn't lead to modern birds. Hundreds of specimens of a larger species of *Confuciusornis* have also been found at the site, but all lacked intact skulls. Researchers believe the birds fell victim to volcanic eruptions, the ash from which preserved their remains.

Extract or story in *Associated Press Headlines* (Online), June 16, 1999.

Fossilised Footprint Site to be Protected.

The site of the oldest footprints in the Northern Hemisphere, on Valentia Island, County Kerry (Ireland), is being purchased by the government and will be declared a national treasure. Simultaneously, legislation is being prepared by the Minister for Heritage, Ms de Valera, to safeguard geological sites from being raided by thieves who sell the fossils to collectors abroad. At the moment there are no laws to stop fossil pirates looting prime scientific sites, which are to be found in at least seven counties.

The Valentia footprints are the "jewels" of the country's fossils and have attracted

major international interest since a Swiss scientist discovered them in 1993. The prints are thought to have been made by a one metre long amphibian more than 385 million years ago. The 15 metre track of parallel footprints, preserved in Valentia Slate outcrops, was precisely dated using minerals in a layer of volcanic ash above them. Similar footprints were discovered preserved in a paving slab in Australia and although they are thought to be older, the dating is less definitive than for the Valentia site.

The site is being bought by the State, and it is planned to provide a carpark and access to viewing points without endangering the footprints. "It will be a flagship project as it is the first site being purchased as an Irish geological monument. It is of huge international importance and has the potential to be a major tourist attraction," according to Dr Mathew Parkes of the Geological Survey of Ireland. Dr Parkes is also investigating other fossil sites which will be listed as heritage areas. Hook Head, in County Wexford, where abundant fossils are exposed in the low cliffs, is being constantly raided by thieves using crowbars to prise off sections of the rockface. "It is a serious problem with unscrupulous people taking fossils away, but the local people have become much more protective of them," said Dr Parkes.

Summary of story in *The Irish Time On The Web*, June 9, 1999.

After Global Search, *T. rex* Jawbone Found.

A priceless *Tyrannosaurus rex* jawbone stolen in 1994 from a California university has been recovered following an international search that uncovered skullduggery in the global fossil trade, officials have announced. FBI agents and scientists proudly unveiled the foot long (30 cm), 68 million year old jawbone, complete with three teeth, which was tracked down through a European dealer.

"It's a great story, and we're thrilled to have it back," said Mark Goodwin, principal scientist at the palaeontology museum of the University of California-Berkeley. "This specimen is very distinct, in part because it is well preserved, and there are not a lot of *T. rex* specimens around," he added.

The fossilised jawbone was originally unearthed by Berkeley palaeontologists working in Montana in 1986, it was returned to Berkeley, site of the world's largest university collection of fossils, and stored in a drawer accessible to researchers. In

late 1994 Goodwin noticed that the jawbone had vanished from its drawer, setting in motion a detective saga that eventually stretched all the way to Europe. Goodwin said he was initially careful not to raise the alarm too loudly, while it was always possible that the jawbone had simple been misplaced, he said he feared that if it had been stolen, a public alert would simply drive the thief, and the jawbone, underground. "Like stolen art, the fossil would have disappeared, for however long, until things cooled off," he said.

In 1997 a colleague of Goodwin spotted a replica of the missing fossil in a private museum in Wyoming, later, another copy of the jawbone was spotted in a fossil catalog. "This confirmed for me that the original was still out there someplace, someone had the original and was making replicas of it," Goodwin said.

The Federal Bureau of Investigation was called in on the case because the missing jawbone was technically federal property as it was recovered from federal land. Agents tracked the fossil market in both Germany and Belgium, working with local authorities, before they eventually found the missing piece, but because the investigation is still active the FBI have declined to provide more details.

David Lindberg, the director of the University of California Museum of Paleontology, said the rapid growth in the commercial fossil market has lead to in increase in fossil theft, although it is still rare. At the Berkeley Museum, which houses more than 20 million fossils, only a handful are listed as missing, but Lindberg said specimens like the *T. rex* jawbone were likely to attract more attention by collectors. "This fossil does not belong to one individual, it belongs to all of us," Lindberg said. "Nature is not going to be making any more *T. rex* jaws."

Summary of story from *Dailynews Online*, July 5, 1999.

Jurassic Giant Constructed.

Teams in Wyoming have assembled the first ever reconstruction of the dinosaur *Seismosaurus*, the "earth shaker", which now commands the crown as the largest dinosaur reproduction ever assembled. Stretching more than 130 feet (more than 40 metres) from head to tail, the dinosaur stands outside the Wyoming Dinosaur Center in Thermopolis, Wyoming, no building was big enough to hold it.

Experts will measure the skeleton for entry in the Guinness Book of World Records. No existing dinosaur mount stretches beyond 100 feet (approx. 33 metres) , and until now the largest museum specimen was a blue whale in the Smithsonian Institution that measures 101 feet (approx. 33 metres).

A Montana company called Dinosauria International sponsored the $US350,000 construction of the Jurassic giant and plans to take it on the road starting in August 1999. It will first visit Dinofest 2000 in Chicago and then to the Smithsonian Institution between March and May 2000. Palaeontologist David Trexler spent four years carving the dinosaur's bones out of styrofoam blocks based on measurements of seismosaur bones excavated in New Mexico during the 1980's. Using the kind of composite casts that form many museum dinosaurs would have made the skeleton far to heavy to stand. he says.

Researchers have always puzzled over a strange dip in the dinosaur's whiplash tail, just behind its body, once Trexler stood back and looked at the finished skeleton he realised the dip put the tail at just the right level to knock the legs out from under an attacking *Allosaurus*, the leading Jurassic predator.

"People have been throwing around numbers as far as how big these animals were and what they looked like, but now we have it right in front of us," Trexler says. "You can begin to see how they would have moved and lived."

Palaeontologist David Gillette, of the Museum of Northern Arizona, who supervised excavation of the *Seismosaurus* remains in New Mexico, says the reconstruction, which he saw in photographs, appears mostly accurate, although its skull and legs look a bit too big. Some researchers suspect the dinosaur's bulky body would have pulled it closer to the ground. 'That's just an informed opinion, of course," says Gillette. "When you're talking about a creature that big, living that long ago, you really can only wonder what they were really like."

Summary of story from *Discovery Channel Online*, July 9, 1999.

Fossil Clues.

The discovery, in Antarctica, of the fossilised remains of huge Cretaceous mosasaurs and plesiosaurs has filled in another piece of the Gondwana fauna which

had previously been missing.

The expedition, led by Jim Martin, of the Museum of Geology in South Dakota, found the remains of four different species of mosasaurs, as well as long necked plesiosaurs. Dr Martin said that the carnivorous sea creatures probably came to Antarctica about 80 million years ago, one type, *Plioplatecarpus*, is believed to have been adapted to relatively shallow water and its discovery in Antarctica suggests the continental masses were once much closer, with connecting marine corridors. "These Antarctic mosasaurs where just fantastic animals, some of them were up to ten metres long," Martin said. "They were armed with teeth that were 75-100 millimetres long, they were eating machines that were designed to eat anything."

Summary of story in *The Sunday Times* (UK), July 12, 1999.

New Type of Dinosaur Unearthed in the Antarctic.

Fossils from a newly discovered land-roving dinosaur adapted to a cool climate have been unearthed on an Antarctic island near the tip of South America in what experts are calling a rare find. The shin and splint bones and part of the thigh bone of a 12 foot (4 metre) long biped herbivore were discovered in February, 1999 on the rocky beach of James Ross Island, 30 miles (50 km) south of Argentina's Marambio Base at the tip of the Antarctic peninsula.

Uncertain of what they had found, two geologists from the Antarctic Institute of Argentina showed the 74 million year old fossilised bones to Fernando Novas, a palaeontologist with the Argentine Museum of Natural Sciences. "This was a type of dinosaur as yet unknown. Now five species of dinosaurs have been discovered in Antarctica," Novas said.

This plant eating member is of the Iguanodon genus, a type of dinosaur first discovered in Britain, it had four limbs, a long tail, a short neck, stood upright and lived in what was a temperate climate, he said. The discovery shows dinosaurs may have been able to adapt to different types of climates, such as the Antarctic climate of the time where average water temperature ranged from 50 to 55 degrees Fahrenheit (10 to 12 Celsius), Novas added.

Prior to this discovery, four different types of dinosaurs, the aquatic mosasaur and land-roving hypsilophodon, ankylosaur and hadrosaur, had been found in Antarctica. Another expedition led by Jim Martin, of the Museum of Geology in South Dakota, found the remains of the duck-billed hadrosaur on the remote Vega and Seymour Islands, also near the tip of South America in early 1998.

"Dinosaur fossils from this part of Antarctica will always be relatively rare because the rocks were deposited in a shallow marine setting. Therefore, the dinosaur remains are those that were washed out from shore," hadrosaur expedition leader Jim Martin said. He said last year's hadrosaur find was the "first concrete proof" that Argentina and Antarctica were connected during the age of dinosaurs.

Novas agreed, " Certainly Antarctica was populated with dinosaurs but most of the continent is covered in ice which makes it difficult to excavate," he said.

Summary of story in *Dailynews Online*, July 12, 1999.

Found: Fiji's Elusive Giants.

The island paradise of Fiji was once home to some truly monstrous reptiles, amphibians and birds. Over the past two years, palaeontologists and archaeologists working for the Central Pacific Colonisation project have found bones from a lost "megafauna" in limestone caves in the west of Viti Levu, the archipelago's main island. Included among the finds is a giant flightless pidgeon which stood 80 centimetres tall and looked like a dodo, an iguana about 1.5 metres in length, a giant frog measuring 25 centimetres, a land crocodile 2 metres long and a giant tortoise.

Project head Atholl Anderson, of the Australian National University in Canberra, says that the discoveries solve a long standing puzzle, as similarly large extinct animals have been found in New Caledonia and Tonga, on either side of the Fijian archipelago. "Its always been suspected that there would be megafauna on Fiji," he says.

Because many of the bones are in fragments, Anderson suspects that the crocodiles dragged them into the caves to eat. Radiocarbon dating of the charcoal in the caves suggests that the fossils are between 20,000 and 25,000 years old. Anderson believes that some of the animals, including the crocodile and the tortoise, disappeared from Fiji about 10,000 years ago when a rise in sea level at the end of the last ice age reduced the Fijian land mass by two thirds. But the iguana, frog and flightless bird may not have become extinct until after people arrived 2800 years ago.

Summary of report in *New Scientist*, July 17,1999.